

turning knowledge into practice

Life Cycle Assessment Of Organic Diversion Alternatives And Economic Analysis For Greenhouse Gas Reduction Options

Project Status

Keith Weitz
February 2, 2009



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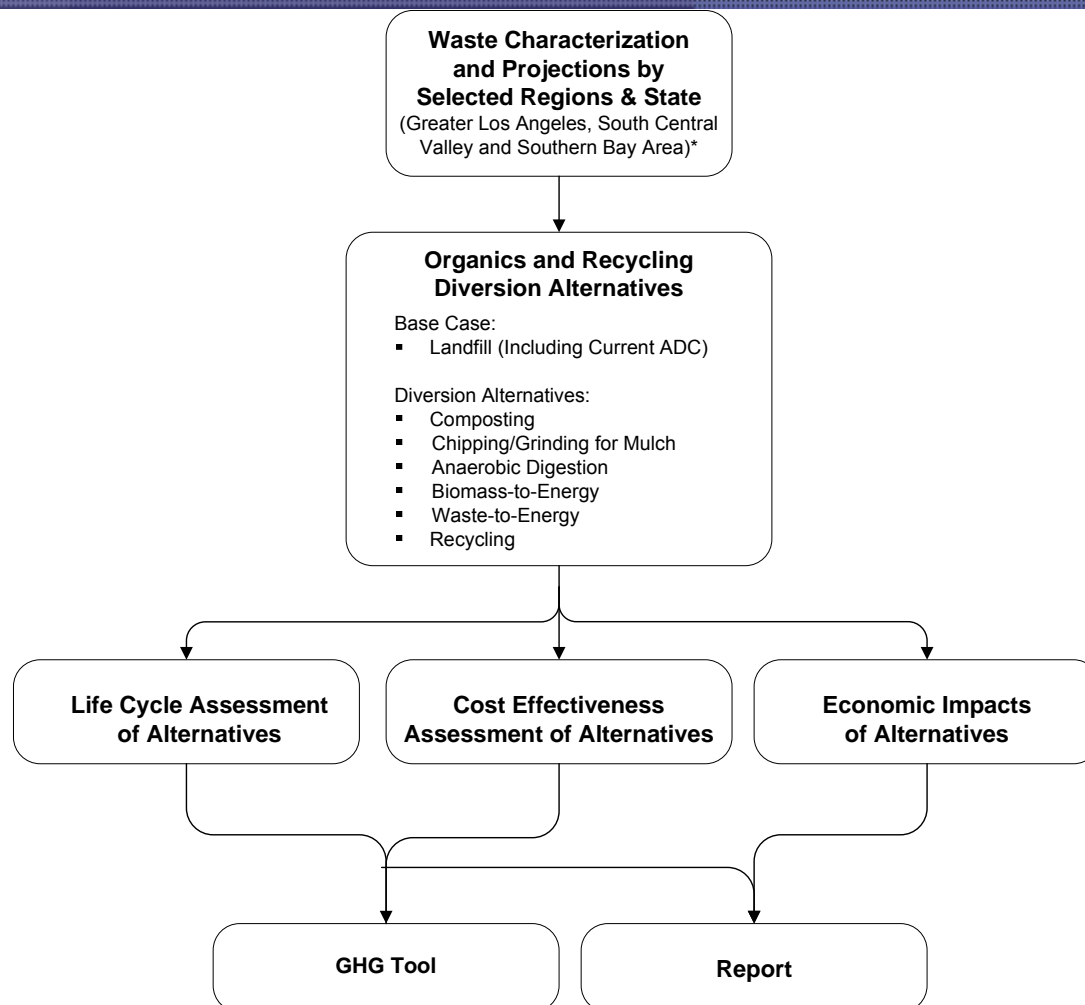
Recap of Project Goals, Tasks, and Outputs

- The goal of the project is to develop data, methods, and tools to analyze the cost and life cycle GHG aspects for organic waste diversion alternatives in California.
 - Want to assess the cost/benefit of alternatives
 - Goal is not to develop GHG inventory, reporting requirements, or reporting protocols.
- Main Tasks:
 - Conduct LCA (focusing on GHG emissions and offsets)
 - Conduct economic analysis
 - Develop CA-specific GHG tool
- Key Products:
 - State and regional LCA and economic analysis of organic waste diversion alternatives (a report)
 - GHG tool

Project Team and Roles

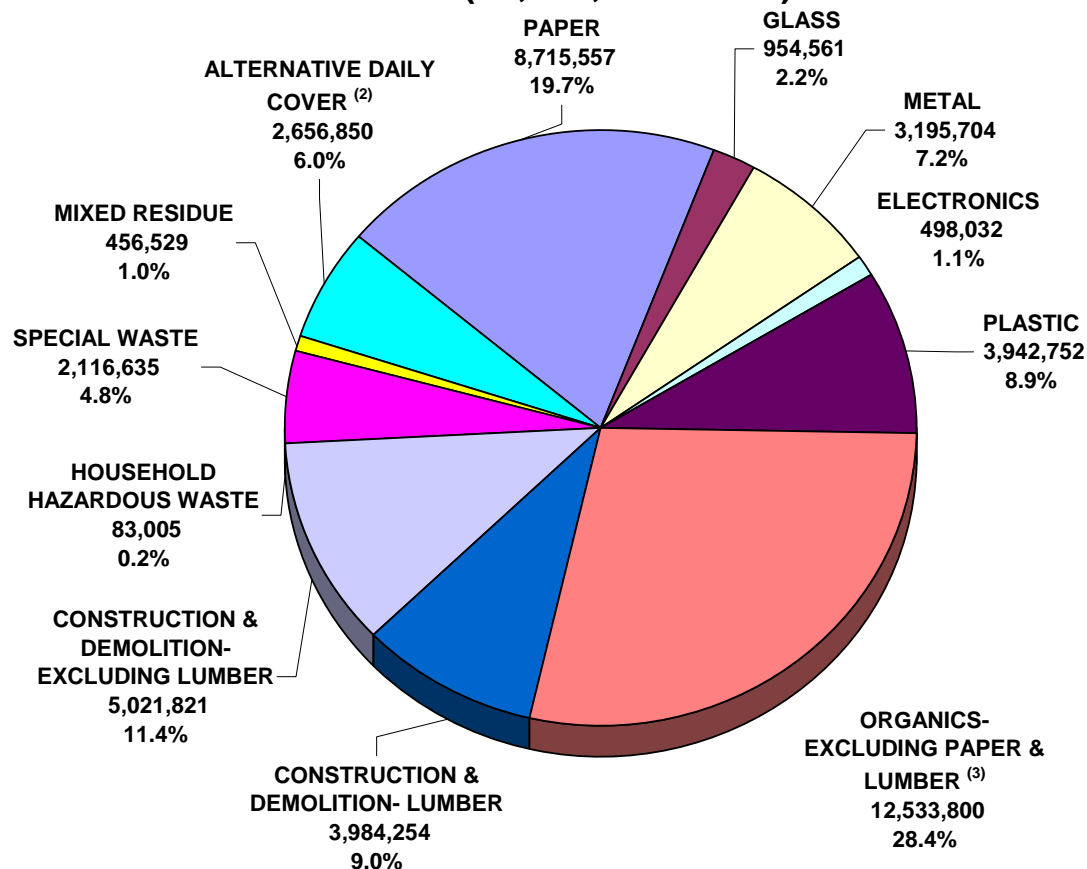
- RTI International (Prime)
 - LCA/GHG analysis
 - GHG tool lead
- R.W. Beck
 - Economics analysis
 - GHG tool support
- Sally Brown
 - Compost research
- Matthew Cotton
 - Facilities information
 - Compost research

Project Components and Flow



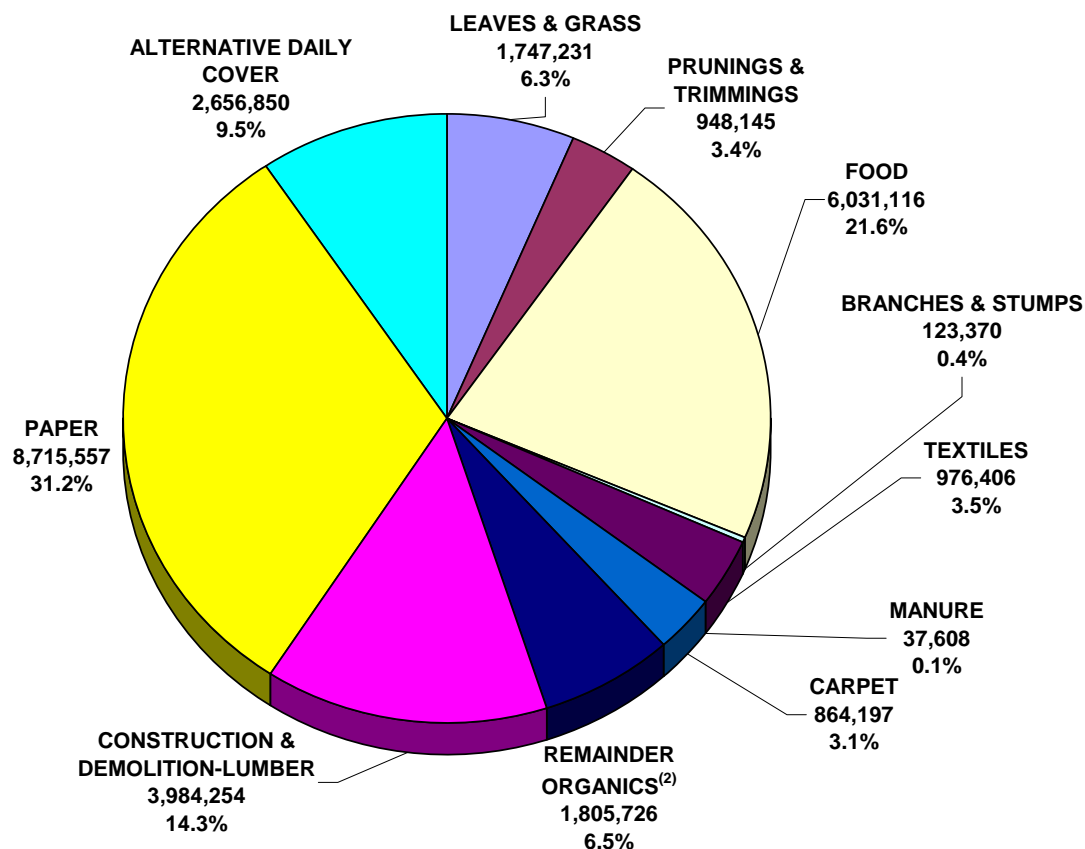
Statewide Total Waste Disposed

2006 TOTAL TONS OF WASTE DISPOSED⁽¹⁾ (44,159,499 TONS)

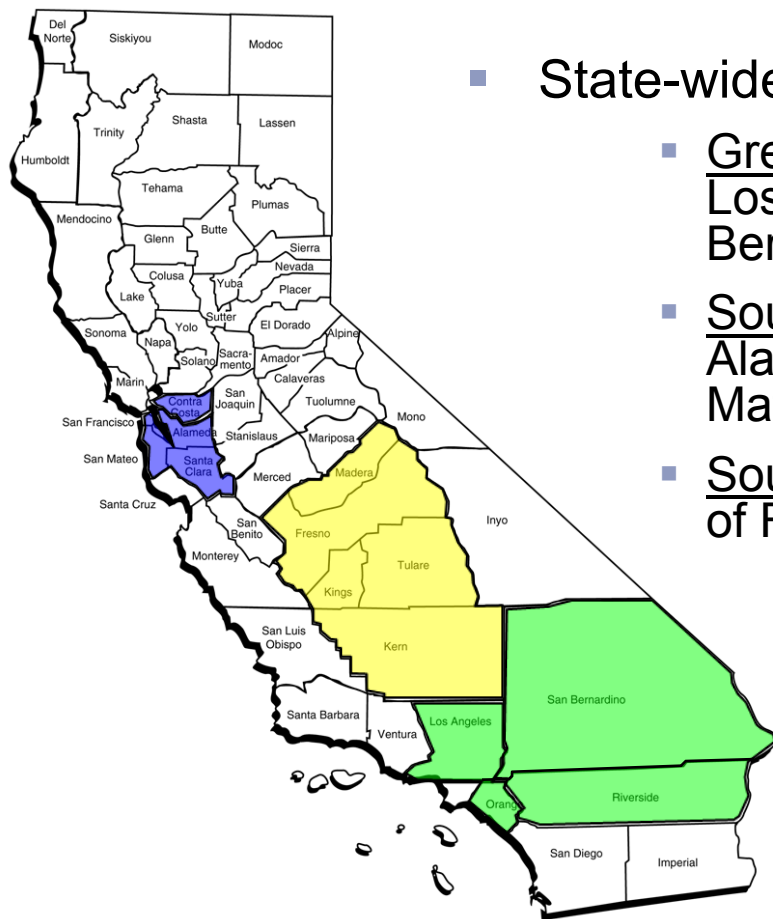


Statewide Total Organics Disposed

2006 TOTAL TONS OF ORGANICS DISPOSED⁽¹⁾ (27,890,461 TONS)



Geographic Scope



- State-wide and regional analyses:
 - Greater Los Angeles: includes the counties of Los Angeles, Orange, Riverside, and San Bernardino.
 - Southern Bay Area: includes the counties of Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara.
 - Southern Central Valley: includes the counties of Fresno, Kern, Kings, Madera, and Tulare.

Diversion Alternatives Under Consideration

Baseline:

- Landfill (including ADC)

Diversion Alternatives:

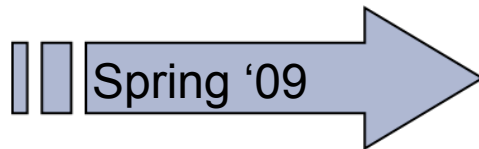
- Composting
- Chipping/Grinding
- Anaerobic Digestion
- Biomass to Energy
- Waste to Energy
- Recycling (recyclables only)



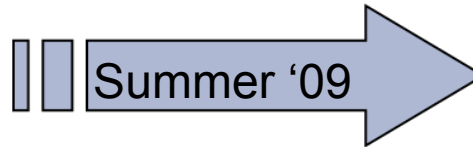
Near-Term Schedule (Next 2 Months)

- Complete data collection and memoranda and submit to Board for review:
 - Documentation of survey data collection
 - Documentation of data recommended for use in the analyses
- Incorporate Board comments into draft compost sampling and analysis and present to stakeholders for review
- Define scenarios, LCA/cost algorithms, and key assumptions recommended for use in the analyses and submit to Board for review

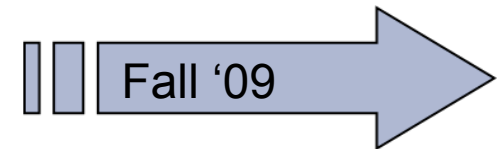
Remaining Schedule



- Draft final data memoranda to stakeholders for review
- Draft final scenario design, methods, and assumptions to stakeholders for review
- Draft final compost sampling and analysis report to stakeholders for review
- Draft LCA and economic analysis report to Board for review
- Prototype GHG tool to Board for review



- Final compost sampling and analysis report
- Draft final LCA and economic analysis to stakeholders for review
- Prototype GHG tool to stakeholders for review
- Stakeholders workshop



- Final LCA and economic analysis report
- Final GHG tool

Agenda for Today

- Focus on data collection activities
- Outline approaches for LCA and economic analyses
- Present conceptual design of the GHG tool
- Q&A session

Key Themes

- This is challenging and complex work.
- Emphasis on treating diversion alternatives in a consistent and objective manner.
- Data collection survey has yielded limited results.
 - Results constrained by data?
- Relying on existing methods; not reinventing the wheel
- Analysis will have fixed data and assumptions whereas GHG tool will allow for more flexibility in data and assumptions.
- An LCA is not the same as a GHG inventory or potential GHG reporting requirement.

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Data Collection

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Outline

- Data collection objectives
- How will data be used?
- Data collection approach
 - Facility surveys
 - Compost sampling/analysis
 - Additional sources
- Status
- Plan for filling data gaps
- Data application:
 - LCA
 - Economic analysis

Data Collection Objectives

- Collect data to capture state and regional characteristics and variation.
 - Waste tonnages and composition
 - Facility capacities and general design
 - Facility operating characteristics
 - Costs/emissions/products
- Develop transparent, consistent, and objective data to characterize alternatives on an equal basis.
- Identify and quantify beneficial offsets where they exist.
 - Energy and materials recovery
 - Compost application

How Will Data be Used?

- Characterize processes in the State and study regions in terms of average design and operating characteristics, such as:
 - Equipment
 - Efficiencies for energy and materials recovery
 - Products and end-use applications
- Develop cost, energy, and emission coefficients:
 - Cost/ton
 - Energy consumption/ton
 - CO₂/ton
 - CH₄/ton
 - N₂O/ton
- Develop hypothetical yet realistic scenarios for analysis.

Main Data Collection Activities

1. Facility data survey
2. Compost application sampling and analysis
3. Additional data collection to fill gaps

Facilities Data Survey – Approach

- Developed a master facilities list for the study regions.
- Developed criteria for selection of ideal participants:
 - Location of facility
 - Size of facility
 - Operating characteristics of facility
 - Existing contacts at facility
- When numerous facilities were identified for an alternative, additional up-front effort was made to determine data availability.
 - Readily available data was compiled and data gaps identified and targeted for additional data collection.

Facilities Data Survey – Approach (cont.)

- Developed survey consisted of several parts:
 - General background information
 - Operating characteristics
 - Energy and emissions related data requests
 - Economic related data requests
- Developed introductory letter and confidentiality agreement.
- Contacted facilities asking them to respond to a questionnaire. Facilities were given the flexibility to provide information in different formats and a confidentiality agreement was offered.
- Follow-up calls were made to make sure information was received and to confirm participation.
- Facility responses were tracked and information compiled.

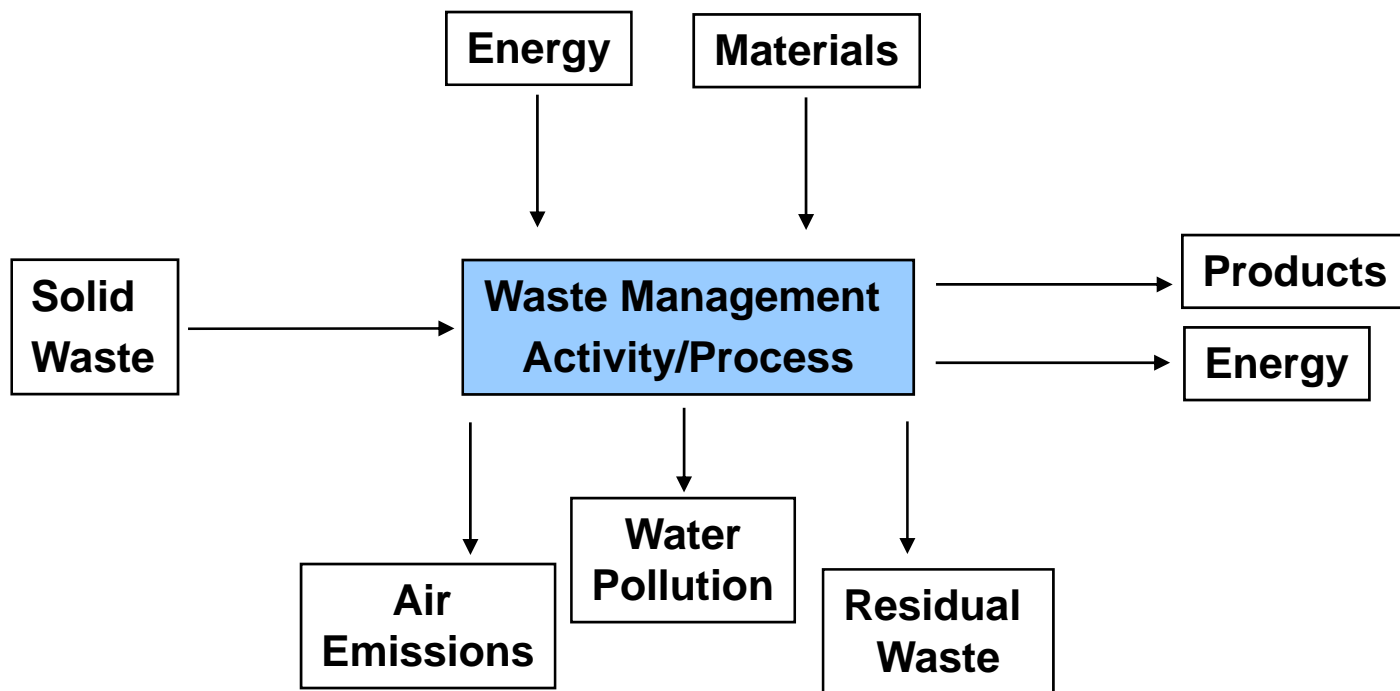
Facility Data Survey Response To-Date

Region	Status	Baseline		Diversion Alternatives				
		Landfill	Composting	Chipping and Grinding	Recycling	Anaerobic Digestion	Biomass-to-Energy	Waste-to-Energy
GLA	Completed	3 (1 partial)	0	2	2	0	0	0
	Dedined	0	0	0	2	0	1	0
	Pending	5	5	2	7	1	0	2
	No Contact	0	0	0	4	0	0	0
	TOTAL	8	5	4	15	1	1	2
SBA	Completed	0	1 (partial)	0	2	0	No facilities in the SBA region	No facilities in the SBA region
	Dedined	1	1	0	1	0		
	Pending	3	2	1	4	1		
	No Contact	1	0	0	4	0		
	TOTAL	5	4	1	11	1	0	0
SCV	Completed	1 (partial)	1	0	0	0	0	No facilities in the SBA region
	Dedined	1	1	0	1	1	2	
	Pending	7	1	0	7	0	4	
	No Contact	0	0	0	3	0	1	
	TOTAL	9	3	0	11	1	7	0
Other	Completed	No facilities contacted in other regions	2	1	No facilities contacted in other regions	0	1	0
	Dedined		0	0		2	1	0
	Pending		2	0		0	21	1
	No Contact		0	0		0	0	0
	TOTAL	0	4	1	0	2	23	1
GRAND TOTAL		22	16	6	37	5	31	3

Next Steps

- Prepare memorandum detailing the results of the survey data collection effort.
- Complete identification and review of additional data and information for possible use to fill gaps.
 - Existing Board sources
 - Existing reports and papers
 - Companies' public information
 - Internal study reports
- Prepare memorandum detailing the facility data and additional data recommended for use in the analyses.
- Finalize compost study report.

LCA Data for Process Characterization



Nature of LCA Data Requested

- Basic facility design and operation
- Materials/process flow
- Energy consumption
- Material inputs
- Efficiency factors
- Emission factors
- Products (energy/materials)
 - Offsets of other products
- Transportation distances

Microsoft Excel - Data_collection_sheets_RTI.xls

Compost				
Design Options				
	Input	Default		
Window		X		
Aerated Static Pile				
General				
	Units	Input	Default	
Number of operating hours	hours/day		8	
Number of days / week	days/week		5	
Wage for operator	\$/hour		8	
Wage for manager	\$/hour		15	
Operating days per year	days/year		262	
Operating hours for blowers	hours/day		1.58	
Paving	\$/acre		75,500	
Grading	\$/acre		5,000	
Fencing	\$/ft		7	
Land acquisition	\$/acre		1240	
Compost pad building	\$/ft		6.5	
Office space	\$/ft		40	
Pile Operation				
	Units	Input	Default for Window	Default for Aerated Static Pile
Composting Pad				
Compost residence time	days		168	60
Compost pile turning frequency	times/week		1	na
Curing Stage				
Curing stage residence time	days		90	na
Density of reject storage piles	lb/yd3		450	na

Example LCA Data Survey For Landfills

California Integrated Waste Management Board Financial and Operating Data Survey - Gas and Leachate Management Information		
SECTION I: 2006 GAS MANAGEMENT INFORMATION		
43	Annual Amount of Gas Flared <i>(Please specify the units)</i>	
44	Annual Amount of Gas Vented <i>(Please specify the units)</i>	
45	Annual Amount of Gas Recovered <i>(Please specify the units and indicate what the gas is being recovered for (i.e. electricity generation for onsite use or sold back to the grid, fuel source, etc.).</i>	
46	Gas collection system efficiency (percentage)	
47	Total gas yield potential (ft3 gas/ton MSW)	
48	Gas quality- carbon dioxide (percentage)	
49	Gas quality- methane (percentage)	
50	Type of energy recovery system (turbine/ boiler/ ICE)	
51	Cost Savings and/or Benefits <i>(Please provide any information on cost savings and/or benefits from the use of the ADC, electricity generation for onsite use, etc.)</i>	

Data Received is Compiled and Standardized

Parameter	City A		City B	
Compost facility design	windrow		windrow	
Compost residency time	90-365	days	90	days
Compost pile turning frequency	5	days	3	days
Curing stage residence time	90	days	30-90	days
Fuel/energy requirements of the windrow turner	500	gal/month	9.27	gal/hr
Fuel/energy requirements of the hammermill	1000	gal/month	9.99	gal/hr
Fuel/energy requirements of the pre-trommel	220	gal/month	2.74	gal/hr
Fuel/energy requirements of the front end loader	Information not provided		2.6-3.27	gal/hr
Percentage of incoming waste as rejects landfilled	10%	percent	8%	percent
Transportation distance to residuals disposal	Information not provided		Information not provided	

How Will LCA Data Be Used?

